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USER'S MANUAL FOR ASTER SOFTWARE SYSTEM

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MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION
ENERGY PLANNING DIVISION — MAY 1977
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USER'S MANUAL
FOR
RASTER SOFTWARE SYSTEM

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MAY 1977

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
HELENA, MONTANA

PREFACE

The Energy Planning Division of the Department of Natural Resources and Conservation purchased an automatic digitizer in 1974. Their intent was to use the equipment to aid in corridor selection for electrical transmission lines.

They wished to digitize several of the inventory maps of the study area (an area that covers the reasonable corridor for the transmission line) and have the computer composite these maps to generate a map that would indicate the environmental impact that would result from a transmission line. To accomplish this a set of software to manipulate digitized cellular maps was written. One of the functions of this software is the compositing of maps. Several outside groups have expressed an interest in this feature.

Because of the differing views of the investigators of an EIS as to how their different inventory maps should be interpreted, the software had to be extremely flexible. In addition, because of the incredibly large number of cells that are generated in maps scanned by automatic digitizers, the software had to be extremely fast.

This manual primarily covers the software system. Many references are made to the scanner and its operation, but to users who are using this software as a stand-alone system (without the scanner), these references can largely be ignored. Sections dealing almost exclusively with the scanner have been put into the appendix.

Dwight Clifford - Author		Patti McCarthy - Typing	
Ann Crowner - Editor		Gordon Taylor - Cartography	

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INTRODUCTION

The Raster Software System (RSS) although written in support of a Broomal Scan Graphics system, can be used as a stand-alone system, or in conjunction with other cellular graphics systems. This system does maintain the same internal coding of its data as used by the Scan Graphics System.

The system was written in IBM-FORTAN G. Although some IBM dependent instructions were used, an effort was made to keep these to a minimum. The system should accommodate many computers with only minor changes to the programs. All programs were written to run in 256K bytes (128K-16 bit words) or less of core assuming the number and size of I-O buffers remains small.

INTERNAL FORMAT OF RSS DATA

The following is a description of the format of map data as it appears internally to the RSS. A full understanding of this coding is not necessary for all users. It is necessary for reading dumps and for tracing down some serious errors. However, all users should find it useful to understand the difference between packed and descriptor files. This difference is explained in this section.

ORGANIZATION

Data resides on tape or disk in 1024 byte records (512-16 bit words). All numbers are IBM integers (two's complement). There are three sections to these data sets: the parameter, title, and map data sections.

PARAMETER SECTION

The first record of 512 variables are parameters to the file. Each variable is two bytes long. Only the first 21 of these variables are used. The meaning of some of these parameters is given below.

Blocksize - Given by the second parameter. This is given in bytes and should be 1024.

File Position - Given by the third parameter. This parameter is of only limited value and should be ignored.

Bit Code for Colors - Given by the seventh parameter. The four low order bits represent the colors white, red, blue, and green. If the bit associated with a particular color is on, a scan of that color appears in the file.

Number of Subfiles - Given by parameter eight. This is the number of coded lines in the data per actual line in the physical map.

Y or Vertical Resolution - Given in lines per inch. Parameter nine is the numerator and parameter ten is the denominator.

X or Horizontal Resolution - Given in lines per inch. Parameter eleven is the numerator and parameter twelve is the denominator.

Y count - The number of cells in the vertical direction is given by parameter thirteen.

X count - The number of cells in the horizontal direction is given by parameter fourteen. A minus one is used for an unknown count.

Gray levels - The number of gray levels used in the file is given by parameter fifteen.

Type of File - A zero in parameter nineteen means the file is a descriptor file, and a one means the file is packed.

End of Line - The number of symbol used to signify the end of a line (EOL) is given by parameter twenty. Commonly 32767 is used.

End of Raster - The number of symbol used to signify the end of the entire raster file (EOR) is given by parameter twenty-one. Commonly minus one is used.

TITLE SECTION

The second record of the file is the title, a string of up to 1022 alpha-numeric characters.

MAP DATA SECTION

The actual coding of the map begins with the third record. The data is coded column-by-column starting with the extreme left column. Each column is coded row-by-row, starting with the bottom row. There are two types of coding.

PACKED FILES

Each cell of a map is inherently accepted or rejected in a packed file. The first number in a line, if it is not the end-of-line symbol, is the first cell to be accepted. The next number is the next cell to be rejected, if it is not the end-of-line symbol. For example, assume a Y count of ten in the following series:

5 8 32767 32767 0 32767

In the first column, cells 5, 6, and 7 are accepted. The cells 0, 1, 2, 3, 4, 8, and 9 are thus rejected. In the second column all ten cells (0-9) are rejected. In the third column all ten cells are accepted.

DESCRIPTOR FILES

Each cell of a map in a descriptor file has some number or descriptor associated with it. The first number of a line is always zero. The next number is the descriptor associated with cell zero. The next number, if it is not the EOL symbol, is the next location at which the descriptor is different from the descriptor of cell zero. The next number is the new descriptor. For example, assume a Y count of 10 in the following series:

0 1 8 2 32767 0 1 2 4 7 2 32767

In the first column, cells 0-7 have descriptor one, and cells 8-9 have descriptor two. In the second column, cells 0-1 have descriptor 1, cells 2-6 have descriptor 4, and cells 7-9 have descriptor 2.

CONVENTIONS AND LIMITS TO THE RANGE OF DESCRIPTORS

All users of RSS are restricted as to the descriptors they are allowed to use.

A descriptor is an integer associated with a cell in a descriptor file. Certain descriptors have, by convention, certain meanings associated with them in some of the programs. The range of descriptors is limited, and certain descriptors are not allowed at all.

CONVENTIONS

For a line work map, the convention is to use the descriptor 1 for part of a line, and 0 for "no data". These conventions are expected in the programs THINNER and FILL.

For map overlays, the descriptor 0 is also used for "no data". This convention is expected in the program OVERLAY.

LIMITS

The range of descriptors is limited. First, two descriptors are not allowed. The integer used for the End-of-Line symbol (32767) is not allowed. The integer used for the End-of-Raster file mark is also not allowed, but the EOR number can be set by the user. Typically, the system will use - 1 if the user does not override this. The EOR symbol should not be the same as the EOL symbol, a descriptor being used, or a legal line number. It is strongly suggested that a negative number be used for the EOR symbol.

The range of descriptors is also limited by the manner in which the descriptors are stored. The number may be no larger (-32768 to 32767) than a bit 16 word can accommodate.

Two programs limit the range further. The program PRINT limits the range to - 10,000 to + 10,000. The program AGGREGATE imposes another limit. In the program AGGREGATE, small matrices of cells are aggregated to single cells. There is a limit to the number of different descriptors that can be found in each matrix. This limit is 21 if the descriptor 0 appears and 20 if it does not. Of course, if these programs are not used, these limits to the range of descriptors do not apply.

If the user suspects a problem with the use of descriptors and symbols in a file, he should see the documentation of the program ANALYZE.

If the user maintains the use of -1 as the EOR symbol, he will seldom encounter problems if he limits the range of descriptors to 0 to 10,000.

COMPOSITING

The composition programs allow the user to create a new map based on the contents of one or more old maps. Only the corresponding cells of the old maps are considered in choosing the contents of a cell in the new map.

There are two general compositing programs -- CORREL and CORREU. CORREL may be easier for the new user; however, it is slow and cumbersome. The experienced programmer should find CORREU easier to use and probably much faster. The user is referred to the documentation of these two programs.

PREPARING MAPS FOR USE WITHOUT THE SCANNER

Cellular data from other systems can be accepted by the raster software system (RSS). There are two programs for creating RSS coded cellular data from general cellular systems -- INPUT and CMSIN. The user should review the documentation on these programs.

If polygonal data is desired, the cellular data are read with either INPUT or CMSIN. The program RECOVER can then be used to recreate the line work. The file can then be run through the Williams' software.* The user should review the documentation on the program RECOVER and the logic flow charts.

SUMMARY OF THE PROGRAMS

The following is a brief summary of the function of each of the programs. For a fuller explanation see each program's write-up.

(1) ACRE--This program calculates acreages by counting cells.

(2) AGGREGATE--This program reduces the number of cells in a map by aggregating small matrices of cells into single cells according to the dominant type in each matrix. A map aggregate I by J (I and J being integers) would have one-Ith as many cells in one direction, and one-Jth as many cells in the other direction.

(3) ANALYZE--This program is a debugging tool for determining the condition of a map file. It is especially useful in recovering as much of a map residing on a defective tape as possible.

(4) CHANGE--This program is used to change the descriptors used in a map file from one value to another.

(5) CMSIN

(6) CMSOUT--These programs (5 and 6) are specialized programs for interfacing the EPD's mapping system with CMS-II.

(7) COPY--This program is used to copy files and change some map file parameters, such as scanning gray level range, and resolution (i.e., cells per inch). There are two types of files--packed file and descriptor file--and COPY can change the type of a file. The definitions of packed file and descriptor file are given in a previous section.

---

* The Williams' software is a package of software available from Broomall Ind., Broomall, Penn.

(8) CORRELATE

(9) CORRELATE WITH USER FUNCTION--These two programs (8 and 9) are used for compositing of maps. CORRELATE can composite up to five maps in a single computer run; CORRELATE WITH USER FUNCTION can go up to ten. With both programs, a new map is created from one or more old maps. The descriptor inserted in the new map is determined by the descriptors of old maps and the way the user has set the program to run.

(10) DUMP--This program gives a decimal dump of map files and is intended primarily for debugging.

(11) FILL--This program helps to convert line work maps to data filled maps.

(12) INPUT--This program is used to interface RSS with other cellular mapping systems. It will read data in a format the user specifies.

(13) INSERT--This program is used to change the value of specific cells within a map. The address of the cells must be known in order to change them.

(14) JOIN--This program is used to join maps together. Since the EPD's raster scanner can scan a map at the maximum size of 9-½ inches by 23 inches, larger maps must be either photographically reduced or cut into smaller segments. Program JOIN can join scanned map segments into one map.

(15) OUTPUT--This program is used to interface RSS with other cellular mapping systems. The program will write out an RSS file according to the format the user specifies.

(16) OVERLAY--This program is used to overlay maps within the computer.

(17) PRINT--This program prints a map file on a line printer. It prints each cell in the map as a character on the line printer. To print these characters up to triple printing can be used.

(18) RECOVER--This program will make line-work maps out of data-filled maps. The terms "line-work maps" and "data-filled maps" are used in this paper to refer to special types of digitized maps. Both are coded in a cellular format but differ in content.

If a scan is made of what cartographers call the line work, the result will be a computer file with cells marked as being either part of a line or not part of a line. These lines presumably separate different soil types or vegetation types, etc. But these categories are not present in the maps; only the lines seperating the different categories are present. This is a line work map.

A map that is ready for compositing should have in each of its cells that category of soil type, vegetation type, etc., that is most characteristic of the area of land that cell represents.

Thus, no actual lines will be present in the map. This type of map is called a data-filled map.

In preparing a map for compositing, the user may start with a scan of the line work. Some of the programs described in this paper were written to aid in converting line work maps to data-filled maps and vice-versa.

A program the EPD has, the Williams' Software which converts cellular format into polygon format, will make polygon lists from line work maps.

(19) SKEW--This program is used to extract a piece of a map or to extend the sides of a map. The user simply gives the beginning and ending X and Y counts. A new map is created from the old. Any new cells that laid outside the old map will have the descriptor zero.

(20) THINNER--This program is used to thin lines in a line work map. A line work map, as mentioned earlier, identifies the lines separating the areas of different characteristics. If these lines are more than one cell wide, this program can thin the lines.

This program is used to calcualte acreage. In a packed file it does this by counting the number of cells accepted. In a descriptor file it counts the number of cells associated with a particular descriptor. It works on data-filled raster file maps.

For example, a user may want to determine the acreage of privately owned forest in a particular area. With an ownership map and a vegetation type map, a new map can be made with either CORREL or CORREU identifying the areas that are both of private ownership and some forest vegetation type. ACRE can then calculate the acreage from this map.

The map is read in on unit 8.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
PER	1-10	F10.0	The number of acres per cell
DES	11-15	I5	The descriptor to look for if the map is a descriptor file.

Sample JCL

Program ACRE — Department of Administration
IBM 370-158

```
// EXEC PGM=ACRE
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
      1.1    7
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=filename,DISP=SHR
/*
```

AGGREGATE

This program reduces the size of a map by reducing matrices of cells into single cells. For example, 5 by 5 martices of cells in one map may be reduced to single cells to create a new map. The descriptor of a cell in the new map is determined by the dominant descriptor (that which appears most often) in its associated matrix of cells.

The descriptor zero is used for "no data" in all of the maps. A threshold can be set for this descriptor, and unless its number of occurrences reaches the threshold, it is not allowed to be dominant. In the case of a road map, a fairly high threshold should be used, a road going through the center of a 5 by 5 matrix of cells may have as few as 5 or 6 cells of the road's descriptor, yet the matrix should be reduced to that descriptor.

MAP INPUT

The map is read from unit 8. The map can be either a descriptor file or a packed file. If it is a packed file, its accepted area is assumed to have the descriptor given in field 11-15 of the first parameter card.

MAP OUTPUT

The new map is written to unit 9. Either a descriptor or a packed file can be written out.

INPUT PARAMETERS (File 1)

Card 1:

NAME	COLUMN	FORMAT	
MR	1-5	I5	Number of rows to be aggregated (such as 4).
MC	6-10	I5	Number of columns to be aggregated (such as 4).
DES	11-15	I5	The descriptor to be used if the inputted map is a packed file. If a packed file is to be made from a packed file then DES should be 1.
THRES	16-20	I5	THRESHOLD - The descriptor 0 (for no data) is not allowed to be dominant unless it reaches this threshold or it is the only descriptor (in case THRES is greater than the number of cells.
TOUT	21-25	I5	Type of map to create. Use zero for a descriptor file and one for a packed file. These are the only two values allowed.

INPUT PARAMETERS (File 2)

Card 1-10:

NAME	COLUMN	FORMAT	
	1-80	40A2	The title of the new map. This overwrites the old title. To change only the first 80 characters, put in only one card. To change more than 80 characters, put in more than one card.

Sample JCL

Program AGGREGATE

Department of Administration
IBM 370-158

```
// EXEC PGM=AGGREGATE
//STEPLIB  DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
    4    5    1    15    0
//FT02F001 DD *
-new title-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=oldfile,DISP=SHR
//FT09F001 DD DSN=newfile,UNIT=SYSDA,DISP=(NEW,PASS),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=6144),SPACE=(TRK,(15,5),RLSE)
//
```

This program examines the structure of map files. If the user suspects that a file is not properly formed, a check against this program will indicate the condition of the file.

Various things can go wrong with map files. For example, several programs allow the changing of the End-of-Raster (EOR) symbol; an improper EOR symbol may get into a map file. A tape may become defective, making part of a file unreadable. A descriptor equal to the End-of-Line (EOL) (32767) or End-of-Raster (normally -1) symbol may get inserted into a file. A program may abend while creating a file (time limit, line limit, etc.) so that only part of the file gets written out. The structure of a map file can often be repaired; some problems and methods of repair are discussed below.

REPAIRING FAULTY MAP FILES

An Improper EOR Symbol

This problem is relatively easy to repair. The EOR symbol should not be a legal line number (between 0 and Y count -1 inclusive) nor should this symbol be used as a descriptor in a descriptor file. If an improper EOR symbol does get in, the user can do the following: (1) run the program COPY on the bad file, (2) use the option COPY for the parameter ALPHA, and (3) set the parameter EORN to a legal EOR symbol. This will correct the problem if the EOL and EOR symbols differ and there are no other problems with the file.

Part of the File is Missing

This can happen if a tape becomes faulty, if a program abends while writing out a map file or if one of the programs discovers an error and terminates with an error. In all of these cases, the first part of a file is properly formed but the last part of it is improper. The correct lines may be recovered. The program ANALYZE tells the user the number of the first incorrect column. The program SKEW may be run to create a file whose x count includes the last correct column and excludes the rest. (Use an end x count one less than the number of the first incorrect column.) This will correct the problem only on descriptor files. If the user has a packed file it should be changed to a descriptor file (with copy) before SKEW is run on the map.

Cell Addresses Out of Order

Cell addresses being out of order usually indicates serious trouble. These lines may not be recoverable. If the user wants to attempt recovering these lines, the following procedure is suggested.

If the file is a descriptor file, run the program CORREU on the single map file, with a function SELECT that simply returns the value given to it. If the map file is a packed file, convert it to a descriptor file with COPY before running CORREU (and back again if the user wishes). These steps will cause the files to be recoded. The files should be reexamined for accuracy and proper structure.

INPUT PARAMETERS

No parameter cards required

Sample JCL

Program ANALYZE

Department of Administration
IBM 370-158

```
// EXEC PGM=ANALYZE
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=filename,DISP=SHR
//
```

This program is used to change descriptors in a descriptor map file. All changes specified will be made. The remaining descriptors, those for which no change has been specified, will be left unchanged.

The input map must be a descriptor file. The new map will also be a descriptor file.

The old map is read in from unit 8. The new map is written to unit 9.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
GRAY	1-5	I5	If Gray > 0 then the new number of gray levels.

Card 2+:

NAME	COLUMN	FORMAT	
DESO	1-5	I5	The old descriptor to be changed.
DESN	6-10	I5	The new descriptor to insert in its place.

INPUT PARAMETERS (File 2)
Card 1-10:

NAME	COLUMN	FORMAT	
	1-80	40A2	The title of the new map. This overwrites the old title. To change only the first 80 characters put in only one card. To change more than 80 characters put in more than one card.

Sample JCL

Program CHANGE

Department of Administration
IBM 370-158

```
// EXEC PGM=CHANGE
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
    16
     1   5
     5   2
```

```
     3   1
     2   1
//FT02F001 DD *
-new title-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=datalib(name),DISP=SHR,LABEL=(,SL,,IN)
//FT09F001 DD DSN=newfile,UNIT=3330-1,VOL=SER=DUAL04,
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=6144),SPACE=(TRK,(20,10),RLSE)
//
```

This program accepts CMS formatted maps and converts them to the RSS format. The expected input is the output of the CMS interface program. CMSIN expects a file of 170 byte records. One row of the map resides on each record, in a decoded form, in columns 48-168.

The CMS programs use alpha-numeric characters as their cell descriptors. RSS coded maps use integers. A series of associations relating an integer with an alpha-numeric character is declared by the user. The pairs are read in on unit one. The range of integers used should be kept to 0-200.

The old CMS file is read on unit 8. The EPD Raster coded file is written to unit 9.

INPUT PARAMETERS (File 1)
Card 1+:

NAME	COLUMN	FORMAT	
CHAR	2	A1	In an association - the character of the CMS map
NUM	3-7	I5	In association - the integer descriptor of the EPD Raster coded map

INPUT PARAMETERS (File 2)
Card 1-2:

NAME	COLUMN	FORMAT	
	1-80	40A2	The string of characters read here will make up part of the title. From 0-2 cards are read in over unit 2.

Sample JCL

Program CMSIN — Department of Administration
IBM 370-158

```
// EXEC PGM=CMSIN
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
 A    1
 B    2
 X    0
//FT02F001 DD *
-part of the new title-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD UNIT=TAPE,VOL=SER-name,DISP=OLD,
// DCB=(RECFM=FB,LRECL=170,BLKSIZE=170),LABEL=(1,NL,,IN,EXPDT=98000)
//FT09F001 DD DSN=newfile,UNIT=3330-1,VOL=SER=DUAL04,DISP=(NEW,CATLG),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=6144),SPACE=(TRK,(4,2),RLSE)
//
```

This program is used to convert RSS coded map data to a form that the NASA-LANDSAT-CMS programs can read.

This program writes out "P" cards. The first 60 columns are written out to unit 10 in the left-hand card format; the next 60 columns are written to unit 11 in right-hand card format. The third group of 60 is written to unit 12 and so on. Only the "P" cards are written and header cards are not printed.

The input map must be in the RSS descriptor file form and is read from unit 8. The symbols tied to the descriptors are declared by the user. If descriptors are found that have not been declared by the user, the symbol asterisk will be used. The range of descriptors allowed is limited.

INPUT PARAMETER (File 1)
Card 1+:

NAME	COLUMN	FORMAT	
NUM	1-5	I5	The descriptor to associate with the following symbol.
SY	6	A1	The symbol to use.

Sample JCL

Program CMSOUT

Department of Administration
IBM 370-158

```
// EXEC PGM=CMSOUT
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
    1A
    2B
    0X
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=oldfile,DISP=SHR
//FT10F001 DD SYSOUT=B
//FT11F001 DD SYSOUT=B
//
```

This program will copy map files from unit to unit. Several programs, such as JOIN and OVERLAY, require that the reading of the map files be interleaved. This program may be used to move the files from tape to disk.

The title of the map may be changed. Any new title is read in on unit 2 and overwrites the old title. Each card overwrites 80 characters.

The type of map file can be changed. The program can be instructed to write out a packed file, descriptor file, or it can be instructed to simply copy the file leaving its type unchanged.

The program can also change the symbol used for "End-of-Raster". The scanner uses a -1. A zero in field 15-19 (on the input parameter card unit 1) will cause the End-of-Raster symbol to remain unchanged. Any nonzero number may be used as the new "End-of-Raster" symbol. This may be used to allow the use of -1 as a descriptor.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
ALPHA	1-4	A4	Put in COPY, DESC, or PAKD. COPY will copy the file as is. DESC will make the file a descriptor file. PAKD will make it a packed file.
IUT	5-9	I5	The input unit number.
IOUT	10-14	I5	The output unit number.
DES	15-19	I5	The descriptor to insert if making a descriptor file. The descriptor to accept if making a packed file.
EORN	20-25	I6	The new end-of-raster number (zero leaves the end-of-raster unchanged).
GRAY	26-30	I5	If > 0 the new number of gray levels.
RESYN	31-35	I5	If > 0 the new numerator for the Y resolution.
RESYD	36-40	I5	If > 0 the new denominator for the Y resolution
RESXN	41-45	I5	If > 0 the new numerator for the X resolution.

RESXD	46-50	I5	If > 0 the new denominator for the X resolution.

INPUT PARAMETERS (File 2)
Card 1-10:

NAME	COLUMN	FORMAT	
	1-80	40A2	The title of the new map. This overwrites the old title. To change only the first 80 characters, put in only one card.

Sample JCL

Program COPY

Department of Administration
IBM 370-158

```
// EXEC PGM=COPY
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
DESC   10   11    3
COPY   12   13
PAKD   14   15    2
//FT02F001 DD DUMMY
//FT02F002 DD *
-new title of map copied to unit 13-
//FT02F003 DD *
-new title of map copied to unit 15-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT10F001 DD DSN=name1,DISP=OLD
//FT11F001 DD DSN=new1,UNIT=TAPE,VOL=SER=tapename,DISP=OLD,
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=1024),LABEL=(2,NL,,OUT,EXPDT=98000)
//FT12F001 DD DSN=datalib(name2),DISP=OLD,LABEL=(,SL,,IN)
//FT13F001 DD DSN=datalib(new2),DISP=OLD,LABEL=(,SL,,OUT)
//FT14F001 DD UNIT=TAPE,VOL=SER=tapename,DISP=OLD,
'' DCB=(RECFM=FB,LRECL=1024,BLKSIZE=1024),LABEL=(1,NL,,IN,EXPDT=98000)
//FT15F001 DD DSN=new3,UNIT=TAPE,VOL=SER=newtape,DISP=OLD,
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=1024),LABEL=(2,SL,,OUT,EXPDT=78001)
//
```

This program can composite up to five maps, a process which may be used to extract overlapping regions of different maps.

Descriptors are inserted into the new map according to the windows defined in the input parameters of the program. The windows are single valued for each map. They should read something like this: Insert the given descriptor where descriptor A is found in map one and descriptor B is found in map 2, etc. The programmer need not declare all possible combinations of descriptors. If a combination is found that has not been declared, then the descriptor zero will be inserted.

All of the input map files must be descriptor files; the created map file will also be a descriptor file.

The user should exercise caution in the use of this program. It is slow. The experienced user should find the program CORREU faster for most applications.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
EORN	1-6	I6	The new end-of-raster symbol. A zero will cause the end-of-raster symbol to be -1.
IOUT	7-10	I5	The output unit number.
IUT(1)	12-16		The input unit numbers for maps 1-5. (A unit number of zero means there are no further maps; i.e., IUT(3) = 0 means there are no more than two maps.)
IUT(2)	17-21		
IUT(3)	22-26	I5	
IUT(4)	27-31		
IUT(5)	32-36		
GRAY	37-41	I5	If not zero, the new number of gray levels.

Card 2+:

NAME	COLUMN	FORMAT	
PARMS(1)	1-6	I6	The new descriptor to insert for this window.
PARMS(2)	7-11		The accept descriptor for this window for maps 1-5.
PARMS(3)	12-16		
PARMS(4)	17-21	I5	
PARMS(5)	22-26		
PARMS(6)	27-31		

INPUT PARAMETERS (File 2)
Card 1-10:

NAME	COLUMN	FORMAT	
	I-80	40A2	The title of the new map.

Sample JCL

Program CORRELATE

Department of Administration
IBM 370-158

```
// EXEC PGM=CORREL
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
         10   11   12
     2    2    1
     1    2    2
     1    0    2
//FT02F001 DD *
-title of new map-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT10F001 DD DSN=datalib(name),DISP=OLD,LABEL=(,SL,,OUT)
//FT11F001 DD DSN=name1,DISP=SHR
//FT12F001 DD DSN=name2,DISP=SHR
//
```

CORREU
(CORRELATE WITH USER FUNCTION)

This program is similar to CORREL. It is used to correlate or composite up to ten maps. The program examines the corresponding cell of each of the input maps before selecting the feature for the cell of the new map.

Descriptors are inserted into the new map according to the user defined function SELECT. This function is supplied with two arguments, NUMBER and CURRNT. Number is an integer *2 variable set to the number of maps being correlated. CURRNT (1) is the descriptor of the first map, CURRNT (2) is the descriptor of the second map, etc. The value returned in SELECT will be the descriptor inserted into the new map. This function is called once for each cell in the maps. All of the maps should be of the same size and shape.

All of the input map files must be descriptor files; the created map file will also be a descriptor file.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
IOUT	1-5	I5	The output unit number.
IUT(1)	6-10		The input unit numbers. (A unit number of zero means there are no further maps; i.e., IUT(3) = 0 means there are no more than two maps.)
IUT(2)	11-15		
IUT(3)	16-20		
IUT(4)	21-25		
IUT(5)	26-30	I5	
IUT(6)	31-35		
IUT(7)	36-40		
IUT(8)	41-45		
IUT(9)	46-50		
IUT(10)	51-55		
GRAY	56-60	I5	If not zero, the new number of gray levels.

INPUT PARAMETERS (File 2)
Card 1-10

NAME	COLUMN	FORMAT	
	1-80	40A2	The title of the new map.

```
Program CORRELATE WITH                  Department of Administration
        USER FUNCTION                   IBM 370-158

// EXEC FORTGCLG
//FORT.SYSIN DD *
      FUNCTION SELECT(NUMBER,CURRNT)
      INTEGER*2 NUMBER,CURRNT(10),SELECT
      rest of program
      END
//LKED.INMOD DD DSN=MAPLIB,DISP=SHR
//LKED.SYSIN DD *
  INCLUDE INMOD(CORREU)
  ENTRY MAIN
//GO.FT01F001 DD *
   10   11   12
//FT02F001 DD *
-title of new map-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT10F001 DD DSN=datalib(name),DISP=OLD,LABEL=(,SL,,OUT)
//FT11F001 DD DSN=datalib(name1),DISP=OLD,LABEL=(,SL,,IN)
//FT12F001 DD DSN=datalib(name2),DISP=OLD,LABEL=(,SL,,IN)
//
```

DUMP

This program will dump map files. The titles are printed in alphanumerics and the rest of the file is printed in decimal. The entire map file can be printed, or a limit can be placed on the number of blocks of data to print. The parameter block of data will normally be printed, although a flag can be set to suppress the printing of this block.

The input parameters to the program are read in on unit one; if nothing is read in on this unit, then all of the file will be printed. The map is read in from unit 8.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
I	1-5	I5	This is the limit to the number of blocks to be printed.
K	6-10	I5	A flag; if K=0 the parameter block will be printed.

Sample JCL

Program DUMP

Department of Administration
IBM 370-158

```
// EXEC PGM=DUMP
//STEPLIB DD DSN=MAPLIB,DKSP=SHR
//FT01F001 DD *
  100    0
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=oldfile,DISP=OLD
//
```

FILL

This program "fills" in the area between lines in line work maps with descriptors which describe the characteristics of the areas.

For example, if the map to be scanned is a precipitation map of four ranges, rather than scanning four separate overlays a single scan may be made; instead of blackening out particular ranges of precipitation, lines are drawn on the map separating the areas.

The scan is first converted to a descriptor file with the program COPY. The descriptor one should be used to represent line work, and the descriptor zero everywhere else (i.e., tell COPY to insert the descriptor one).

Somewhere within each separate polygon, a descriptor describing the range of precipitation in which that area lies should be inserted. This is done with the program INSERT. (Also, broken lines can be repaired with INSERT.)

The program FILL then fills in the areas with whatever descriptor is found in the area. If more than one descriptor is found within an area then error messages are printed, unless one of the descriptor is a priority descriptor and the other is not.

Finally, to remove the lines, change the descriptor of the lines to zero, and aggregate the map with a somewhat high threshold.

ERROR CONDITIONS

Whenever a non-zero descriptor overwrites another non-zero descriptor of the same priority, an error message is printed. This error message gives the location at which the overwriting takes place. This may happen when two descriptors are inserted into an area or when there is a break in some line.

ERROR RECOVERY

If the wrong descriptor is placed into an area, the file may be repaired. If the error is caused by a break in a line, that line must first be repaired. This can be done with INSERT (once the location of the break is known). The user should tell INSERT to insert the descriptor one into the location of the break. If the location of the break is not known, its approximate location can be found from a Versatec plot. The programs SKEW and PRINT can then give its exact location.

To change the descriptor, insert a high priority descriptor into the area and rerun FILL (see parameter MUST on following page). High priority descriptors (greater than 100) will overwrite low priority descriptors (less than 100). The high priority descriptor can then be changed to the proper descriptor for the area.

The old map is read in from unit 8. The new map is written to unit 9.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
GRAY	1-5	I5	New number of gray levels. If gray = 0 the old number will be used.
MAXPAS	6-10	I5	The maximum number of passes through the map FILL is allowed to make. This should be an even number.
MUST	11-15	I5	The minmum number of passes through the map FILL is allowed to make. This should be an even number. When the zero count of two successive passes is the same the program tries to stop. If the user is correcting an area by using a high priority descriptor to overwrite another non-zero descriptor, this parameter should be set high enough to be sure the area is completely filled, since the zero count may not change in successive passes.

INPUT PARAMETERS (File 2)
Card 1-10:

NAME	COLUMN	FORMAT	
	1-80	40A2	The title of the new map. This overwrites the old title. To change only the first 80 characters, put in only one card. To change more than 80 characters, put in more than one card.

Program FILL

Department of Administration
IBM 370-158

```
// EXEC PGM=FILL
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
    8    4    2
//FT02F001 DD *
-new title-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=oldfile,DISP=SHR
//FT09F001 DD DSN=datalib(newfile),DISP=OLD,LABEL=(,SL,,OUT)
//FT10F001 DD UNIT=SYSDA,SPACE=(TRK,(25,10)),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=12288)
//FT11F001 DD UNIT=SYSDA,SPACE=(TRK,(25,10)),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=12288)
//
```

This program is used as an aid in transferring cellular data from some other cellular mapping system into ERGIS-RSS.

The program expects the input map to use characters as its identifiers. For each cell a single character should appear. That alpha-numeric character should indicate the type or sub-classification that is characteristic of that cell.

Since RSS uses integers as its identifiers, the characters must be converted to integers. Associations of single characters to integers are declared by the user. These are set up in the input parameters over unit number one. Any characters found that have not been declared in an association will take on the integer zero.

The format of the input map file is declared by the user. This declaration is made over unit number four. If no declaration is made (i.e., if unit four is dummied) then a format of ((80A1)) is assumed. The characters read in should be read with an A1 format.

The size of the map file created is variable. The user must give the Y count (the number of cells in the map in the Y or vertical direction-that is across the page as the program PRINT would print the file). This count is given over unit one.

The following is an example:

Associations:

```
A - 1
B - 2
5 - 5
4 - 3
C - 0
```

Format:

```
(4A1)
```

Y count:

```
4
```

Input File

```
ABB4
AAAA
AA55
CC5C
```

The above example would produce the following RSS file map.

```
map:  1 2 2 3
      1 1 1 1
      1 1 5 5
      0 0 5 0
```

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
YCNT	1-5	I5	The number of cells in the Y direction

Card 2+:

NAME	COLUMN	FORMAT	
CHAR	1	A1	Character of a character-descriptor association
DES	2-6	I5	The descriptor of this association.

INPUT PARAMETERS (File 2)
Card 1-6:

NAME	COLUMN	FORMAT	
	1-80	40A2	New title.

INPUT PARAMETERS (File 4)
Card 1:

NAME	COLUMN	FORMAT	
FMT	1-80	80A1	The format of the input map file.

Sample JCL

Program INPUT

Department of Administration
IBM 370-158

```
//    EXEC  PGM=INPUT
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
   10
A   10
B   11
1    1
2    2
3    5
//FT02F001 DD *
-new title-
//FT04F001 DD *
(10A1)
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD *
AAABBBBB11
AABBBBBBB1
ABBBB2BBBB
BBB2222BBB
B222222BB3
//FT09F001 DD DSN=datalib(Name),DISP=OLD
//
```

INSERT

This program inserts descriptors into given locations in map files. This program may be used in conjunction with the program FILL to create data filled maps from a scan of the line work of a map. See the documentation on FILL for a further explanation of the process.

The insertion of the descriptors may be done conditionally. The program FILL treats the descriptor zero as no data and the descriptor one as part of a line. The program can be instructed not to write over the line work (descriptor one). It can be instructed to overwrite any descriptor or only the descriptor zero.

It is important to remember that in numbering the lines in a map, the line numbers start with zero, not one.

The old map is read from unit 8. The new map is written to unit 9.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
GRAY	1-5	I5	If >0 the new number of gray levels.

Card 2+:

NAME	COLUMN	FORMAT	
DES	1-5	I5	The descriptor to insert.
XCWT1	6-10	I5	The X coordinate.
YCWT1	11-15	I5	The Y coordinate.
CODE	16-20	I5	If CODE = 0 then replace only zeros.
			If CODE = 1 then replace any descriptor except one.
			If CODE = 2 replace only zeros and ones.
			If CODE = 3 replace any descriptor.
			If CODE = 4 do not insert.

INPUT PARAMETERS (File 2)
Card 1-10:

NAME	COLUMN	FORMAT	
	1-80	40A2	The title of the new map. This overwrites the old title. To change only the first 80 characters, put in only one card.

Sample JCL

Program INSERT

Department of Administration
IBM 370-158

```
// EXEC PGM=INSERT
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
   16
    1  348 221     3
    1  349 221     3
    1  348 220     3
    1  349 220     3
//FT02F001 DD *
-new title-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=oldfile,DISP=SHR
//FT09F001 DD DSN=newfile,UNIT=SYSDA,DISP=(,PASS),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=6144),SPACE=(TRK,(10,5),RLSE)
//
```

This program can join map files together. The files may be joined by situating one directly above the other, or by placing them alongside each other. If any offsetting needs to be done, the program SKEW should be used first.

If the maps are joined in the Y direction, the second map (from IUT2) is placed directly above the first map. The columns of the two maps will coincide. The first row of the second map will be one past (directly above) the last row of the first map.

Likewise, if the maps are joined in the X direction, the second map will be placed directly to the right of the first map. Thus, the rows of the two maps coincide. If the adjacent sides of the two maps differ in size, the map with the smaller adjacent side will be padded with zeros.

It should be noted that when a file is printed on a line printer, the Y direction is across the page and the X direction is down the page. To visualize a map file placed on top of or to the right of another file, tilt the printer output 90°.

The parameter indicating the number of gray levels used can be altered.

The new map will be a descriptor file. It is written to unit 9.

The first map is read from unit 10 and the second map is read from unit 11.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
XORY	1-2	A2	An X in column 2 will cause the maps to be joined in the x direction (A Y will cause it to join in the y direction).
DES	3-7	I5	The descriptor to insert if creating a descriptor file.
GRAY	8-13	I6	If greater than zero, this will be the new number of gray levels used.

INPUT PARAMETERS (File 2)
Card 1-10:

NAME	COLUMN	FORMAT	
	1-80	40A2	The title.

Program JOIN

Department of Administration
IBM 370-158

```
// EXEC PGM=JOIN
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
 Y    1    8
//FT02F001 DD *
-new title-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT09F001 DD DSN=newfile,UNIT=SYSDA,DISP=(,PASS),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=6144),SPACE=(TRK,(10,5))
//FT10F001 DD DSN=lowerfile,DISP=SHR
//FT11F001 DD DSN=upperfile,DISP=SHR
//
```

OUTPUT

This program is used as an aid in transferring cellular data from ERGIS-RSS to other cellular mapping systems.

ERGIS-RSS uses integers as its identifiers. Each cell will have an integer associated with it (in a descriptor file) indicating the type or sub-classification that is characteristic of that cell.

When a map is written out by this program a character is written for each cell. The user can set up character-integer associations. If the user has not declared otherwise, the integers 0-9 will be associated with the characters 0-9. All other integers will be associated with the character *.

There is a limit to the range of descriptors. This limit is -10,000 to 10,000. If a descriptor is found in the map that is outside the range then the character * will be written and an error message will be printed.

The user can specify the format the data is to be written in. The characters written should be written with an A1 format. The format is read in over unit four. If unit four is dummied, a format of ((80A1)) will be assumed.

INPUT PARAMETERS (File 1)
Card 1+: (Descriptor Files)

NAME	COLUMN	FORMAT	
DE	1-5	I5	The descriptor of an association.
CR	7	A1	The character of an association.

Card 1: (Packed Files)

NAME	COLUMN	FORMAT	
DESR	1-5	I5	The descriptor of the reject region.
DESA	6-10	I5	The descriptor of the accept region.

INPUT PARAMETERS (File 4)
Card 1:

NAME	COLUMN	FORMAT	
FMT	1-80	80A1	The format to be used.

Program OUTPUT

Department of Administration
IBM 370-158

```
// EXEC PGM=OUTPUT
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
    1 K
    2 W
    0 Z
//FT04F001 DD DUMMY
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=name,DISP=SHR
//FT09F001 DD SYSOUT=B
//
```

This program will overlay maps. It should be used on maps with data that inherently should not exist in the same cell in more than one map. When data does exist in the same cell in more than one map, the descriptor of that cell will be determined by the priority on the maps. Note that the descriptor zero is used for "no data"; therefore, a zero in a high priority map would not overwrite a non-zero descriptor.

The maps are read in on units 10-25. Since the reading of the map files is interleaved, the maps should reside on devices such as disks.

The maps are read in ascending priority (i.e., the first map, unit 10, has the lowest priority). If a cell is claimed by more than one map, then it will take on the descriptor of the map of highest priority claiming it.

The newly created map will be a descriptor file. It is written to unit 9.

If an old map is a packed file, the accept area will take on the descriptor of the associated element of array DES. (See input parameters)

That portion of OVERLAY designed to overlay packed files has not yet been written.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
NUM	1-5	I5	Number of maps (up to 16).
GRAY	6-10	I5	If > 0 the new number of gray levels.
ECORN	11-16	I6	If ≠ 0 the new end-of-raster symbol.

Card 2:

NAME	COLUMN	FORMAT	
DES	1-4	16I4	The descriptors to insert if the file is a packed file.
	5-8		
	9-12		
	13-16		
	17-20		
	21-24		
	25-28		
	29-32		
	33-36		
	37-40		
	41-44		
	45-48		
	etc.		

Program OVERLAY

Department of Administration
IBM 370-158

```
// EXEC PGM=OVERLAY
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
    2    4
   5   1
//FT02F001 DD *
-new file-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT09F001 DD UNIT-TAPE,VOL=SER=tapename,DISP=OLD,
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=1024),LABEL=(1,NL,,OUT,EXPDT=98000)
//FT10F001 DD DSN=file1,DISP=SHR
//FT11F001 DD DSN=file2,DISP=SHR
//
```

PRINT

This program will print a map file on a line printer. One character is used for each cell of the file. If the file is too large to be printed in this manner, then either the program AGGREGATE or SKEW should be used first to reduce its size. The map file must be a descriptor file.

The file can have a Y count larger than 132 cells. The first 132 characters are printed on unit 10, the next 132 characters on unit 11, and so on. Thus DD Statements must be declared for at least as many units as will be needed.

This program also allows the lines of the map to be numbered. The input parameter DIGITS specifies how many digits are to be printed in this numbering.

The old map is read from unit 8.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
DIGITS	1-5	I5	An integer > 0. The number of digits to use in numbering the lines of output.

Card 2+:

NAME	COLUMN	FORMAT	
DES	1-6	I6	The descriptor to which this set of print characters is being tied to.
CHAR1	7	A1	The set of print characters (up
CHAR2	8	A1	to triple printing).
CHAR3	9	A1	

Sample JCL

Program PRINT

Department of Administration
IBM 370-158

```
// EXEC PGM=PRINT
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
    4
     1-
     2+
     3x+
     40x+
```

```
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=name,DISP=SHR
//FT10F001 DD SYSOUT=(S,,0303),DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//FT11F001 DD SYSOUT=(S,,0303),DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//FT12F001 DD SYSOUT=(S,,0303),DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//
```

The above example assumes that the Y count of the map file from unit 8 is 3x132 (396) characters or less. If it is larger, more print units would have to be declared (units 13, 14, etc.).

There are two usable forms a raster map file can have: (1) a line work map, and (2) a data-filled map. A line work map contains only lines, which separate different regions. In a data-filled map the regions appear as areas; for example, any cell that has a certain soil type will have the descriptor of that soil type. The Williams' software expects line work maps. This program will take data-filled maps and convert them to line work maps.

The resolution of the new map will be double the resolution of the old map (in both the X and Y directions). The old map must be a descriptor file; the new map will be either a packed or descriptor file.

The old map is read in on unit 8. The new map is written to unit 9.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
TYPN	1-5	I5	If TYPN≠0, a packed file will be created. If TYPN=0, a descriptor file will be created.
GRAY	8-10	I5	If a descriptor file is created and if GRAY≠0, then GRAY is the new number of gray levels.

INPUT PARAMETERS (File 2)
Card 1-10:

NAME	COLUMN	FORMAT	
	1-80	40A2	The title of the new map. This overwrites the old title. To change only the first 80 characters, put in only one card.

Program RECOVER

Department of Administration
IBM 370-158

```
// EXEC PGM=RECOVER
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
    1    2
//FT02F001 DD *
-new title-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=oldfile,DISP=SHR
//FT09F001 DD DSN=newfile,UNIT=SYSDA,DISP=(,PASS),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=6144),SPACE=(TRK,(10,5))
//
```

SKEW

This program can extract a piece of a map or it can extend any of the sides of a map by padding it with zeros. The beginning and ending X and Y counts are supplied by the user. If either beginning count is less than zero, the map will be padded with zeros. If either beginning count is greater than zero, lines of the old map will be excluded from the new map (remember that the numbering of lines begins with zero and not one). The end counts will usually be the last line included, although an end count of 32767 will cause the end count to remain the same in the new map as it was in the old. Giving end counts greater than those present in the old maps causes the new map to be padded with zeros.

The map created will be a descriptor file written to unit 9. The old map is read from unit 8.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
YCNTB	1-6	I6	The beginning Y count. Positive numbers cause lines in the old map to be ignored. Negative numbers cause the new map to be padded with zeros.
YCNTF	7-12	I6	The ending Y count. A 32767 causes the ending Y count to be the same as in the old map.
XCNTB	13-18	I6	The beginning X count.
XCNTF	19-24	I6	The ending X count.

INPUT PARAMETERS (File 2)
Card 1-10:

NAME	COLUMN	FORMAT	
	1-80	40A2	The title of the new map. This overwrites the old title. To change only the first 80 characters, put in only one card.

Program SKEW

Department of Administration
IBM 370-158

```
// EXEC PGM=SKEW
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
     0 32767    -1   263
//FT02F001 DD *
-new title-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=oldfile,DISP=SHR
//FT09F001 DD DSN=newfile,UNIT=SYSDA,DISP=(,PASS),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=6144),SPACE=(TRK,(2,1))
//
```

THINNER

This program is used to thin lines in a raster map file to a uniform thickness of one cell. This program does not break lines but it may widen the gaps of already broken lines. By convention, the descriptor one is used for line data in descriptor files.

The program sweeps across the map, removing cells from the line as it goes. The number of sweeps required to thin a line is approximately (W-1)/2, where W is the width of the line in cells.

The old map is read in on unit 8; it can be either a descriptor or a packed file.

The new map is written to unit 9. It can be either a descriptor or packed file.

INPUT PARAMETERS (File 1)
Card 1:

NAME	COLUMN	FORMAT	
GRAY	1-5	I5	If GRAY ≠ 0, then it is the new number of gray levels.
MAXPAS	6-10	I5	The maximum number of passes through the map allowed.
MUST	11-15	I5	The minimum number of passes allowed.
THRES	16-20	I5	If THRES or fewer cells removed on a pass, the program will stop.
TYPN	21-25	I5	If TYPN ≠ 0, a packed file will be created. If TYPN ≠ 0, a descriptor file will be created.

INPUT PARAMETERS (File 2)
Card 1-10:

NAME	COLUMN	FORMAT	
	1-80	40A2	The title of the new map. This overwrites the old title. To change only the first 80 characters, put in only one card. To change more than 80 characters, put in more than one card.

Sample JCL

Program THINNER

Department of Administration
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```
// EXEC PGM=THINNER
//STEPLIB DD DSN=MAPLIB,DISP=SHR
//FT01F001 DD *
    0    2    1   20    0
//FT02F001 DD *
-new title-
//FT03F001 DD SYSOUT=A,DCB=RECFM=UA
//FT06F001 DD SYSOUT=A,DCB=RECFM=UA
//FT08F001 DD DSN=oldfile,DISP=SHR
//FT09F001 DD DSN=newfile,UNIT=SYSDA,DISP=(,PASS),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=6144),SPACE=(TRK,(10,8))
//FT10F001 DD UNIT=SYSDA,SPACE=(TRK,(10,8)),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=12288)
//FT11F001 DD UNIT=SYSDA,SPACE=(TRK,(10,8)),
// DCB=(RECFM=FB,LRECL=1024,BLKSIZE=12288)
//
```

APPENDIX A

PREPARING MAPS FOR USE WITH THE SCANNER

Preparing maps involves several steps. First, physical maps are prepared by cartographers. These maps can then be scanned, and the digitized files produced may require processing through several steps before they are ready for use. The steps are given below.

The user may desire the final digitized maps in polygon form, cellular form, or both. In any case, the user should know the intended final form of the files at the time the maps are prepared for scanning. Some shortcomings of the system must be overcome at this time. The user should review this entire document before preparing overlay maps and line work maps for scanning.

Two forms of maps are prepared for scanning. These are discussed below.

OVERLAYS

Overlays are a series of maps, one representing each subtype or classification within a map. Each overlay appears as one or more areas delineated by shading for the particular subtype or classification. After scanning, these overlays can be combined to a single map within the computer.

When overlaying maps, a certain artifact appears. There is a highly accurate method of registering the maps on the scanner; however, neither the registration nor the overlays are perfectly accurate. For example, if overlays are used which identify only the regions of their subtypes or classifications, without any overlap into adjoining regions, a kind of shadowing may appear, as demonstrated in the following illustration.

In the illustration, the overlay of type 1 was scanned slightly to the left of where it should be. In this example, a strip of type zero, "no data" would appear between the two regions. The map can be aggregated with a high threshold to remove this strip (maps being prepared for cellular files are usually aggregated to rectangular cells to take out the distortion of the line printer). If this aggregated file is used to create a polygonal file, however, lines will tend to be jerky and will

not follow the actual lines very well. This effect gets larger as aggregation matrices get larger. Such problems may be minimized if care is used in scanning and small aggregation matrices are used.

By preparing the physical maps differently, polygon files may be produced from overlays which provide more accurate and clear files than the method mentioned above. The added benefits should justify the added cartographic costs before this is done. When the computer overlays maps, it gives each map a different priority. When an area is claimed by more than one map, it will take on the subtype or classification of the map of highest priority. When any two overlays follow the same border, the area of the overlay of lower priority is extended slightly into the region of the area of the overlay of higher priority. Thus the overlay of highest priority has only regions of its subtype or classification "blackened".

LINE WORK

A line work map consists of lines separating the regions of different subtypes or classifications. The physical maps and the digitized files of the line work must have complete line work with no breaks in the lines. To enable the scanner to pick up the line reliably, the user should choose a pen size to uniformly draw the line work. At 100 lines per inch resolution, a "0" pen works well. It is better to make the lines too thick than too thin if the map is not heavily detailed.

If a polygonal map file is desired, a scan of the line work can be thinned (optional), repaired by SKEW, PRINT, and INSERT (if needed), and run through the Williams' software. The Williams' software requires a packed file. SKEW, PRINT, and INSERT require descriptor files. A file's type can be changed with COPY.

If a cellular map file is desired, the process is slightly different. Again, the line work must be complete and there can be no breaks in the lines. If there are breaks, they may be repaired either by rescanning or through the use of programs SKEW, PRINT, and INSERT.

The line work is changed from packed format to the descriptor format with the program COPY. If the lines need thinning (they usually do), they can be thinned with the program THINNER. Somewhere within each closed polygon, a descriptor should be inserted that represents the character of that region. This can be done two ways: (1) the program INSERT can be used to insert the correct descriptor, or (2) a scan of dots, one for each region, can be made and overlayed onto the line work. A scan of the study area is helpful here; therefore, marks outside the study area, such as registration marks, are not inserted. A combination of these two methods may be used.

The program FILL is then used to fill in these polygons. The program CHANGE is used to change the descriptor type used for the lines to zero. The map can then be reduced to the correct size with AGGREGATE. Because of all the lines running through the map (now tied to descriptor type zero), a high threshold should be used with AGGREGATE to assure their disappearance.

CHECKING THE DIGITIZED MAPS FOR ACCURACY

The best method found for checking the maps is to print out the map file on the matrix plotter. The map should be printed at the same scale as the original or base map. The matrix plotter does not print at the same resolution in the X and Y direction; some fine tuning on the resolution parameters (with the program COPY) should be done.

One map should be printed for each character. This map can be overlayed on the original by using a light table. In this way, all corrections to one category can be identified in one overlay.

REGISTRATION OF THE SCANNER

For general documentation on the operation of the scanner, the user is referred to the GP-100 Users Manual. Registration of documents on the scanner, however, has been troublesome and is not covered in the users manuals. It is discussed below.

The GP-100, given the same windows on two separate scans, may not begin scanning at the same point. A method is needed for checking the registration of a scan while the scan is being made. A reasonable method has been found. Maps are registered by "zeroing in" on a registration mark in the lower left-hand corner of the document. This registration mark should be off the actual map area the user wants in the scan.

The mark used is a cross with a slash through it, as shown below.

The idea is to just barely pick up this cross. The lower left-hand corner of the scan should appear as shown.

By using the CRT at an enlarged scale, the mark can be seen clearly at the beginning of the scan. If the mark is not positioned correctly, the scan can be stopped immediately. The actual area of the document desired can be extracted from the file with the program SKEW.

As the software cannot adjust the tilt of a document, the document must be mounted properly before scanning. A second registration mark in the lower right-hand corner is used to aid in the mounting.

APPENDIX B

FLOW CHARTS

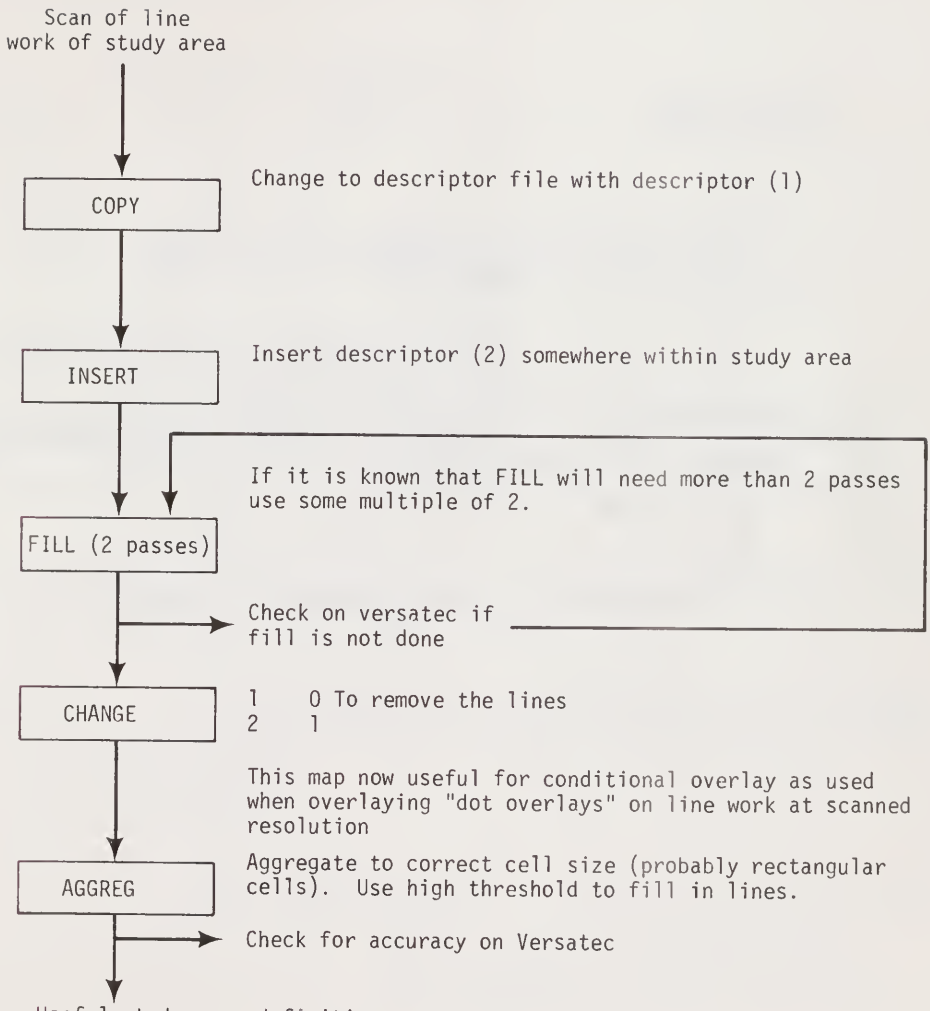
The following section gives sample logic flows for the Raster Software System. It gives sample ways in which the programs may be combined to perform different tasks. The logic flows within each program are not shown.

Although this system is useful for general compositing, sample logic flows for general compositing are not given. Typically a general composite is performed with a single run of the program CORREU (or CORREL).

The sample flow charts do show how "raw data" (the digitized files as they come from the scanner) are processed into useful maps.

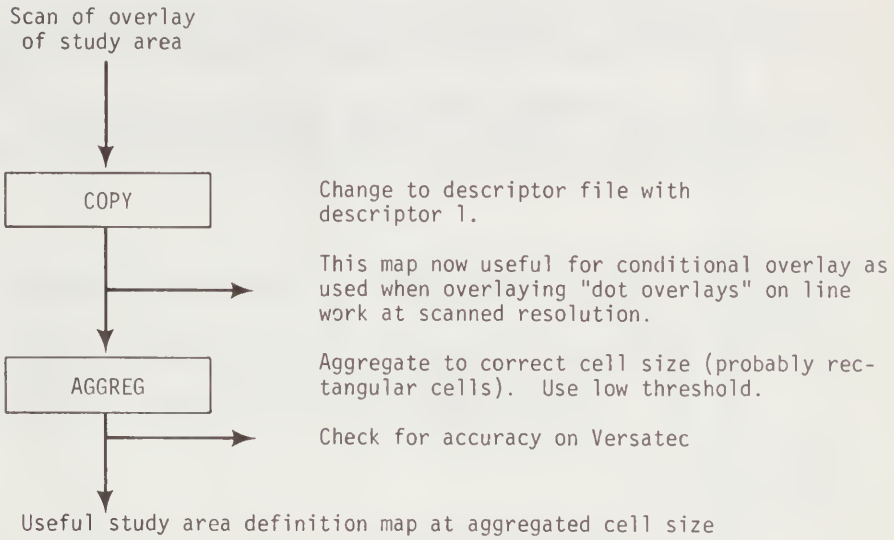
FLOW CHART #1: CELLULAR MAP DESIRED

To create study area map
from line work



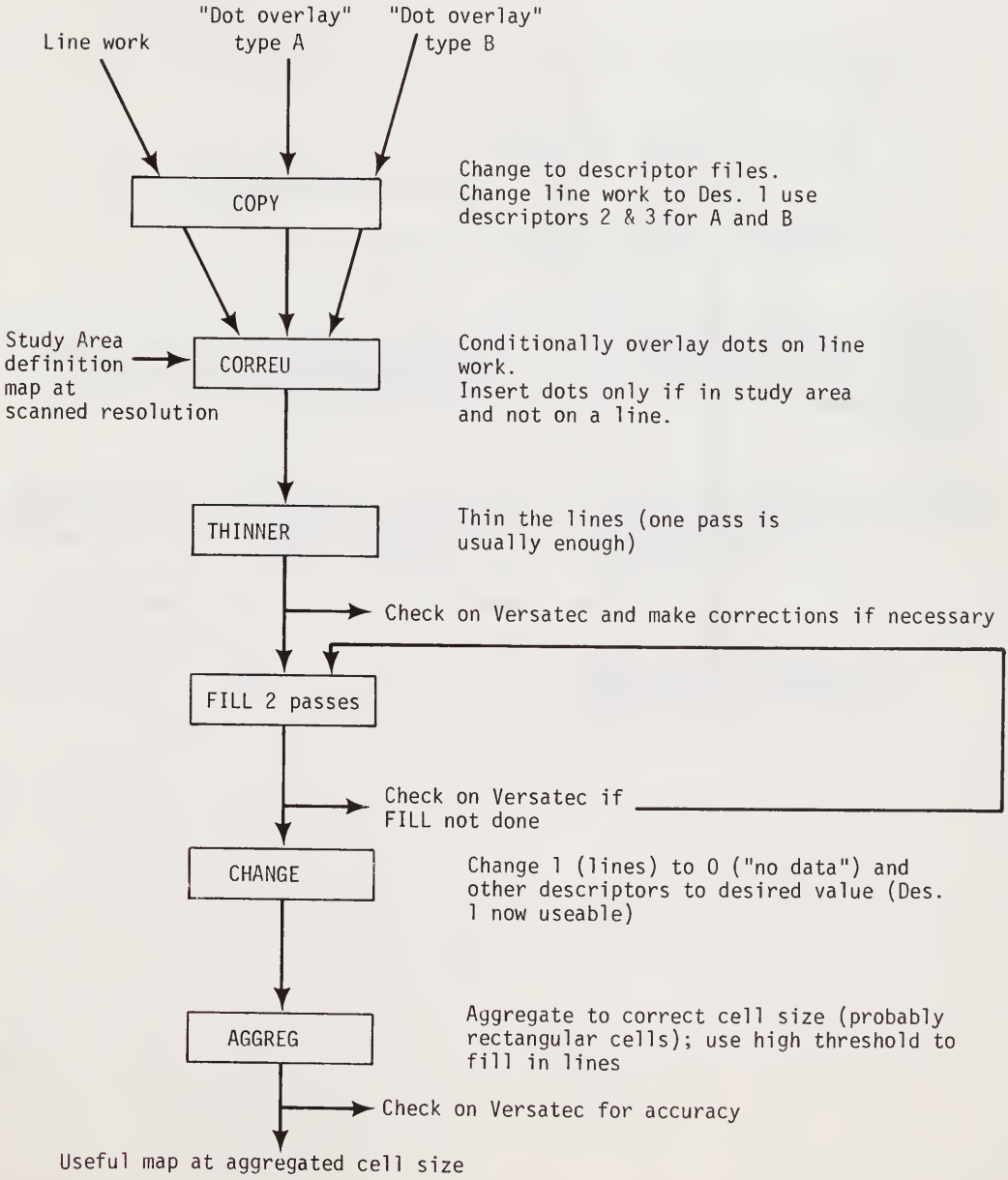
FLOW CHART #2: CELLULAR MAP DESIRED

To create study area map
from a (single) overlay



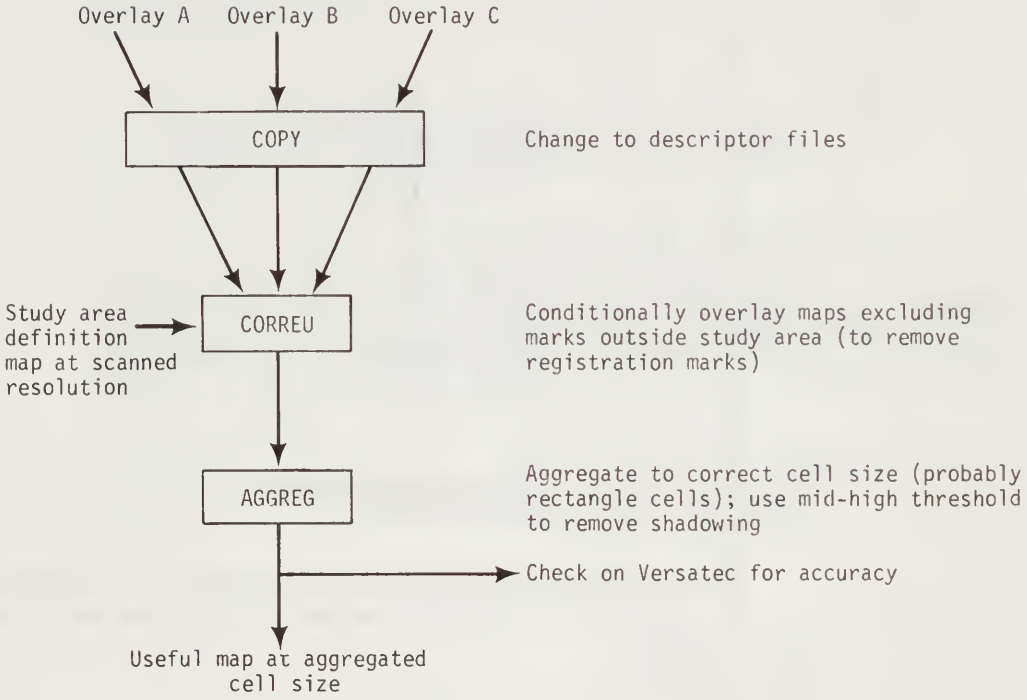
FLOW CHART #3: CELLULAR MAP DESIRED

To create a map from
line work and "dot overlays"



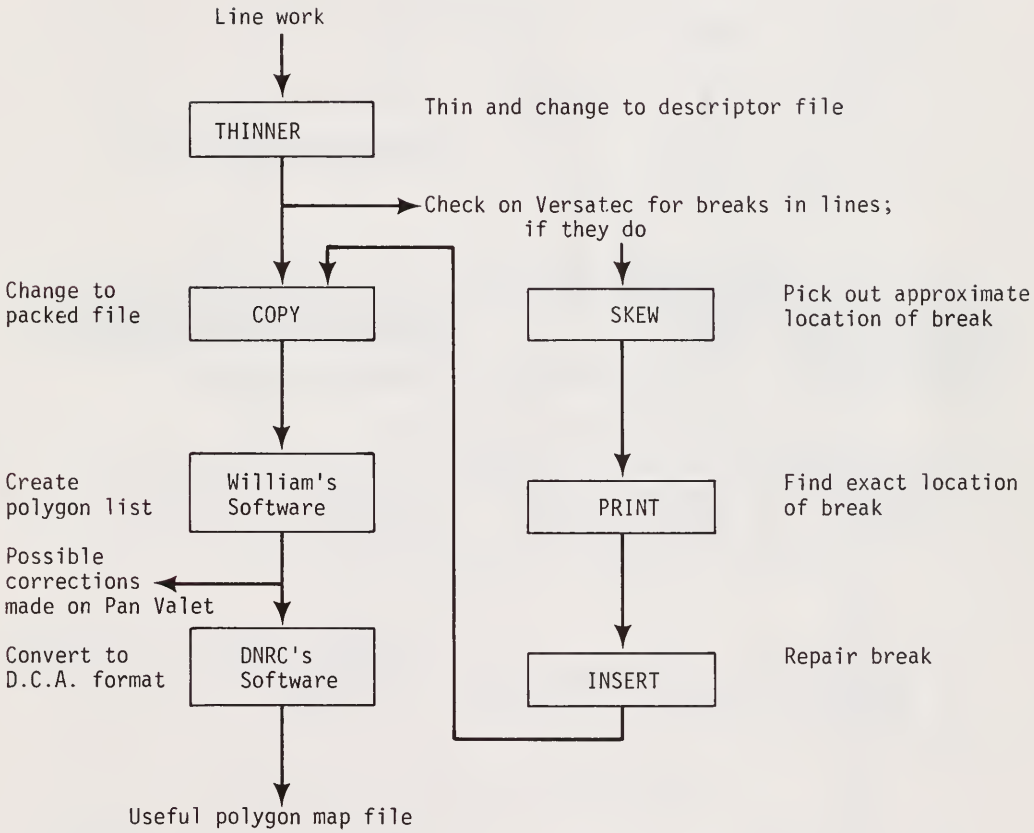
FLOW CHART #4: CELLULAR MAP DESIRED

To create a map from overlays



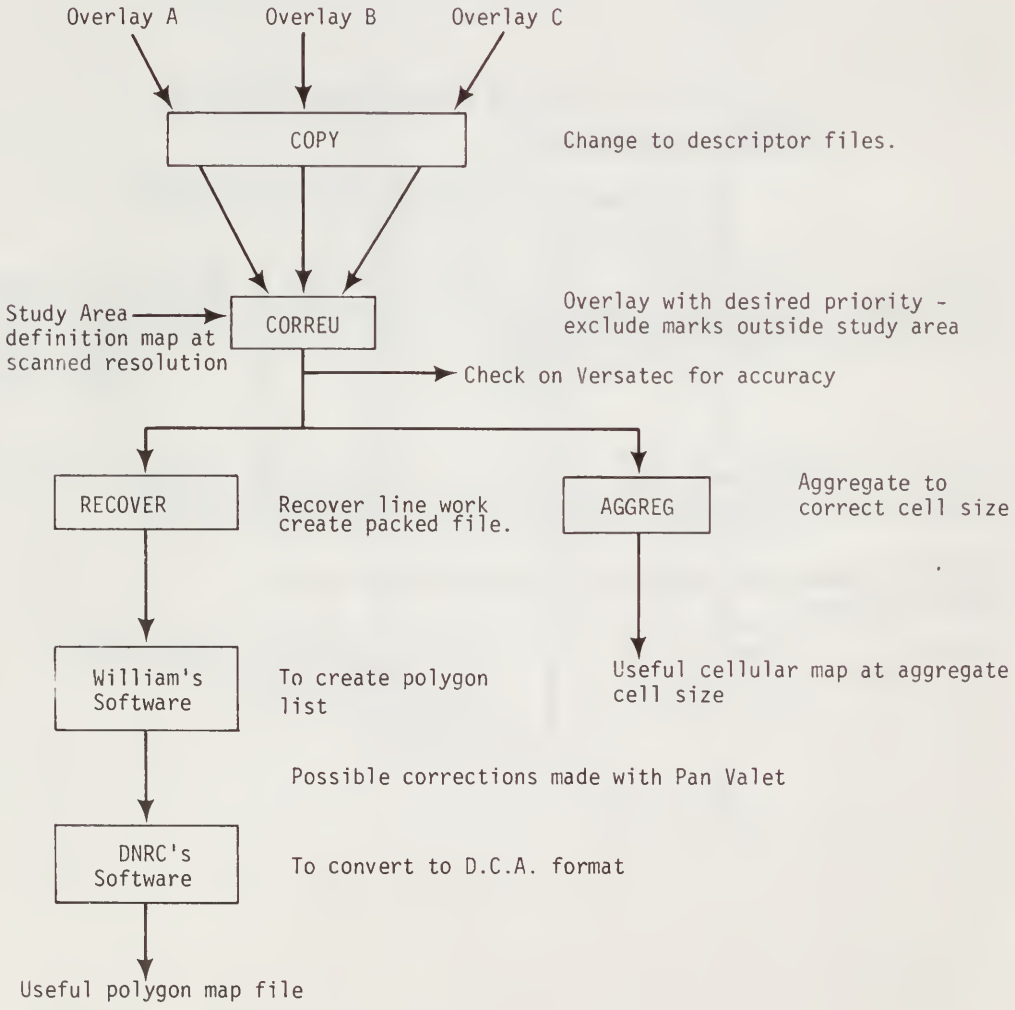
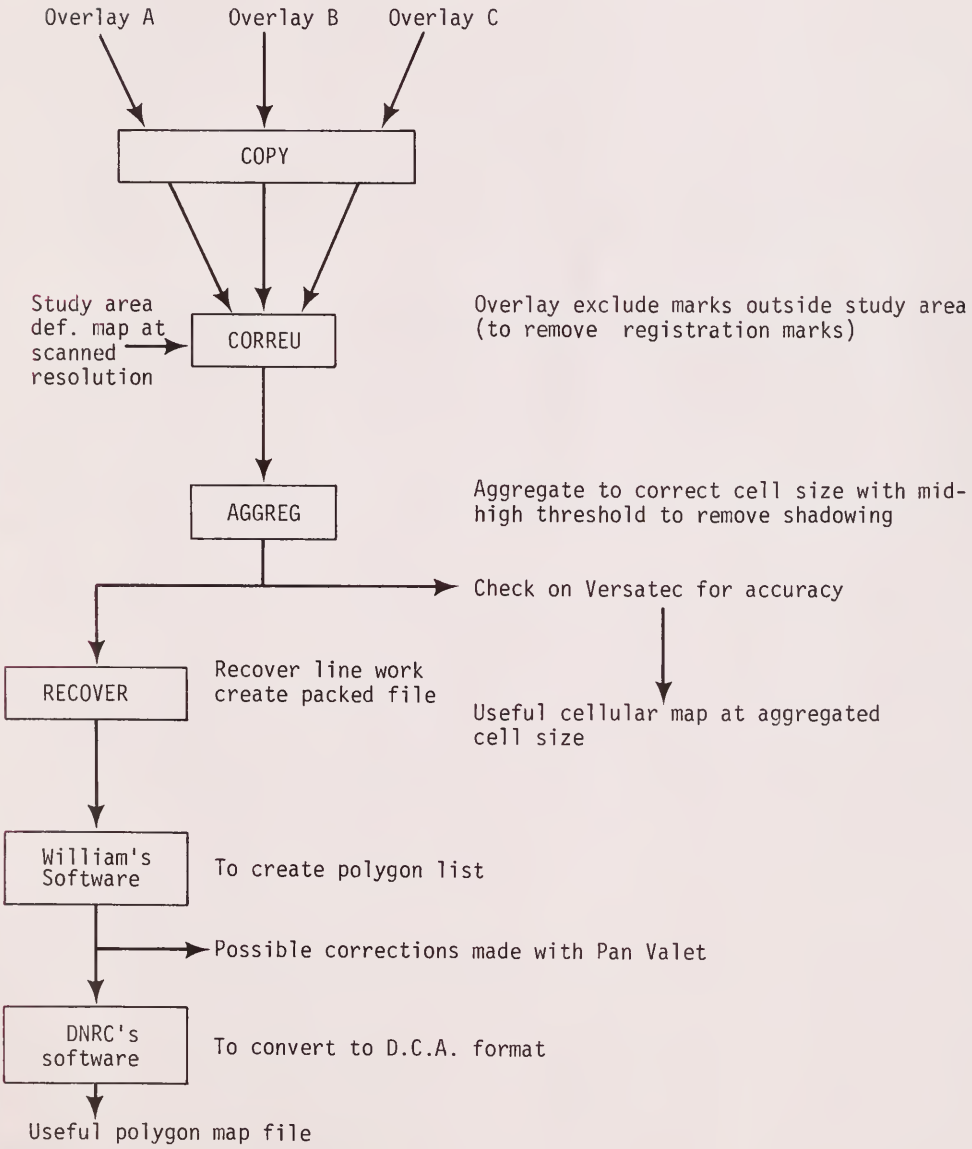
FLOW CHART #5: POLYGON MAP DESIRED

To create a map from
the line work



FLOW CHART #6: CELLULAR & POLYGON MAPS DESIRED

To create maps from specially prepared overlays (as described on page) for highly accurate polygon file.



To create maps from overlays for polygon file with somewhat "jerky" lines